What is claimed is:

1. An apparatus for reducing false contour in a digital display panel, the apparatus comprising:

a data converter, which processes an image signal such that a gray level of the image signal exists within a predetermined range;

an error diffuser, which diffuses an error between a gray level of a current pixel in a current frame of the image signal received from the data converter and a gray level of the current pixel in the current frame after being subjected to gray-level change, to pixels adjacent to the current pixel in the current frame;

a first gray-level changing unit, which receives the image signal from the error diffuser, calculates a difference in a gray level between each pixel in the current frame of the image signal and a pixel corresponding to the current frame pixel in a previous frame of the image signal, and changes the gray level of the current frame pixel based on the gray level difference such that transition in an emission pattern of higher weighted subfields among subfields, which illuminate according to the gray level of the current frame pixel, between the current frame pixel and the previous frame pixel is minimized; and

a subfield converter, which converts a subfield according to a gray level output from the first gray-level changing unit.

2. The apparatus of claim 1, wherein the subfield converter represents the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule such that the weights D0, D1, D2, D3, D4, D5, and D6 are arranged in an arithmetical progression so that D3=D0+D1+D2+1, D4=D3+d, D5=D4+d, and D6=D5+d and such that the weights D7, D8, and D9 satisfy D7=D8=D9=D6+d.

3. The apparatus of claim 1, wherein the subfield converter represents the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule such that highest weights D7, D8, and D9 do not allow emission pattern transition to occur with an increase in the gray level of the image signal, and such that higher weights D3, D4, D5, and D6 allow an off state to have a regular distribution with the increase in the gray level of the image signal.

4. The apparatus of claim 1, wherein the subfield converter represents the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule such that an emission pattern is changed only at the weights D0, D1, D2, D3, D4, D5, and D6 with a change in the gray level of the image signal.

5. The apparatus of claim 1, wherein the first gray-level changing unit comprises:

a frame memory part, which receives the image signal from the data converter and stores information on a currently input frame as previous frame information for a next input frame;

an pixel transition determiner, which receives current frame information of the image signal from the error diffuser and the previous frame information from the frame memory part and determines a degree of gray-level transition between each pixel in the current frame and a corresponding pixel in the previous frame;

a still image determiner, which receives the degree of gray-level transition from the pixel transition determiner and determines whether the current frame is a still image based on the degree of gray-level transition and a predetermined level;

a pixel group number storage part, which stores pixel group number information regarding to each pixel in the previous frame based on the gray level of the pixel after being subjected to the gray-level change; and

a second gray-level changing unit, which when the still image determiner determines the current frame as not a still image, changes the gray level of the current frame according to a predetermined method using the current frame information output from the error diffuser, the degree of gray-level transition output from the pixel transition determiner, the previous frame information stored in the frame memory part, and the pixel group number information stored in the pixel group number storage part.

6. The apparatus of claim 5, wherein the second gray-level changing unit outputs a gray level of the previous frame when the still image determiner determines the current frame as a still image.

7. The apparatus of claim 5, wherein the pixel transition determiner determines the degree of gray-level transition between a particular pixel in the current frame, i.e., a current frame pixel, and a corresponding pixel in the previous frame, i.e., a previous frame pixel, using an average of gray level of all pixels included in a square block that has a predetermined size and has the current frame pixel at its center, an average of absolute values of the gray levels of all of the pixels included in the square block except for the current frame pixel, an average of absolute values of differences between the gray levels of all of the pixels included in the square block and respective gray levels of all pixels included in a square block that has the predetermined size and has the previous frame pixel at its center, and an absolute value of a difference between the gray level of the current frame pixel and the gray level of the previous frame pixel.

8. The apparatus of claim 5, wherein the still image determiner determines the current frame as a still image when a ratio of the number of pixels, which are determined as having less motion than a predetermined amount in the current frame of the image signal received from the pixel transition determiner, to a total number of pixels in the current frame is greater than the predetermined value.

9. The apparatus of claim 5, wherein the second gray-level changing unit compares the degree of gray-level transition from the pixel transition determiner with a predetermined level and changes the gray level of each pixel in the current frame based on the result of the comparison.

10. The apparatus of claim 5, wherein the second gray-level changing unit compares the degree of gray-level transition from the pixel transition determiner with a predetermined level and when the degree of gray-level transition is lower than the predetermined level and when a pixel group number of a pixel in the current frame, i.e., the current frame pixel, is different from a pixel group number of a corresponding pixel in the previous frame, i.e., the previous frame pixel, changes the pixel group number of the current frame pixel to a pixel group number close to the pixel group number of the previous frame pixel among pixel group numbers adjacent to the pixel group number of the current frame pixel

11. The apparatus of claim 5, wherein when the subfield converter represents the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule, the second gray-level changing unit changes weights representing the gray level of the current frame pixel such that an emission pattern of the current frame is the same as that of the previous frame with respect to the weights D3, D4, and D5.

12. The apparatus of claim 5, wherein when the subfield converter represents the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule, the second gray-level changing unit changes weights representing the gray level of the current frame pixel such that a distribution of on states at the weights D3, D4, D5, and D6 is regular in a diagonal direction when the on states of the weights D0 through D9 are arranged in an increasing order of the gray levels.

13. The apparatus of claim 5, wherein when the gray level of the image signal is divided into 25 gray levels according to a predetermined standard and then pixel group numbers from zero are sequentially allocated to the 25 gray levels, the second gray-level changing unit does not change gray levels corresponding to the pixel group numbers 0 and 1.

14. The apparatus of claim 13, wherein the second gray-level changing unit obtains pixel group number information of the previous frame pixel after being subjected to gray-level change using the following formula:

$$Index_{prev}\{p_e'(i,j;t-1)\} = Index\{p(i,j;t-1)\} - Index_{diff}\{p_e'(i,j;t-1)\},$$

where the $Index$ function indicates a pixel group number corresponding to an input gray value, $Index_{diff}$ indicates a difference between the pixel group number of an original previous frame pixel before being subjected to error diffusion and a pixel group number corresponding to a gray value obtained after the original previous

frame pixel is coded and subjected to gray-level change, $p_e'(i,j;t-1)$ indicates the gray level of the previous frame pixel after being subjected to gray-level change and error diffusion, and $p(i,j;t\text{-}1)$ indicates the gray level of the original previous frame pixel.

15. The apparatus of claim 5, wherein when the degree of gray-level transition received from the pixel transition determiner is lower than the predetermined level, the second gray-level changing unit changes the gray level of the current frame using the following formula:

$$
\begin{aligned}
& if(index_{prev}\{p_e'(i,j;t-1)\} < index\{p_e(i,j;t)\}) \\
& p_e'(i,j;t) = [index\{p_e(i,j;t)\} - 1] \times D_3 + D_{3-1} \\
& if(index_{prev}\{p_e'(i,j;t-1)\} > index\{p_e(i,j;t)\}) \\
& p_e'(i,j;t) = [index\{p_e(i,j;t)\} + 1] \times D_3 \\
& if(index_{prev}\{p_e'(i,j;t-1)\} = index\{p_e(i,j;t)\}) \\
& p_e'(i,j;t) = p_e(i,j;t)
\end{aligned}
$$

where the *Index* function indicates a pixel group number corresponding to an input gray value, $Index_{diff}$ indicates a difference between the pixel group number of an original previous frame pixel before being subjected to error diffusion and a pixel group number corresponding to a gray obtained after the original previous frame pixel is coded and subjected to gray-level change, $p_e'(i,j;t-1)$ indicates the gray level of the previous frame pixel after being subjected to gray-level change and error diffusion, $p(i,j;t\text{-}1)$ indicates the gray level of the original previous frame pixel, and D_3 indicates a fourth weight when the subfield converter represents the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule.

16. The apparatus of claim 5, wherein when the subfield converter represents the gray levels of subfields in the image signal with weights D0 through

D9 in an increasing order from a lower to a higher value according to a predetermined rule, the second gray-level changing unit changes the gray level of the current frame pixel according to the following formula using a pixel group number corresponding to an emission pattern of higher weighted subfields such that a difference between the emission pattern of weights corresponding to the gray level of the previous frame pixel after being subjected to gray-level change and the emission pattern of weights corresponding to the gray level of the current frame pixel is minimized:

$$p_e^{'}(i,j;t) = [index\{p_e(i,j;t)\} + \Delta] \times D_3 + D_3 - 1,$$

where $p_e^{'}(i,j;t)$ indicates the gray level of the current frame pixel obtained as the result of the gray-level change, $index\{p_e(i,j;t)\}$ indicates a pixel group number corresponding to the gray level of the current frame pixel, D_3 indicates a fourth weight, and Δ indicates an increment of a pixel group number minimizing a PD value within the range of variation of pixel group number from –2 to 2.

17. A method of reducing false contour in a digital display panel, the method comprising:

(a) processing an image signal such that a gray level of the image signal exists within a predetermined range;

(b) diffusing an error between a gray level of a current pixel in a current frame of the image signal resulting from step (a) and a gray level of the current pixel in the current frame after being subjected to gray-level change to pixels adjacent to the current pixel in the current frame;

(c) calculating a difference in a gray level between each pixel in the current frame of the image signal resulting from step (b) and a pixel corresponding to the current frame pixel in a previous frame of the image signal resulting from step (b), and changing the gray level of the current frame pixel based on the gray level difference such that higher weighted subfields among subfields, which illuminate according to the gray level of the current frame pixel, are on a continuous on or off state; and

(d) converting a subfield according to a gray level resulting from step (c).

18. The method of claim 17, wherein step (d) comprises representing the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule such that the weights D0, D1, D2, D3, D4, D5, and D6 are arranged in an arithmetical progression so that D3=D0+D1+D2+1, D4=D3+d, D5=D4+d, and D6=D5+d and such that the weights D7, D8, and D9 satisfy D7=D8=D9=D6+d.

19. The method of claim 17, wherein step (d) comprises representing the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule such that highest weights D7, D8, and D9 do not allow emission pattern transition to occur with an increase in the gray level of the image signal, and such that higher weights D3, D4, D5, and D6 allow an off state to have a regular distribution with the increase in the gray level of the image signal.

20. The method of claim 17, wherein step (d) comprises representing the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule such that an emission pattern is changed only at the weights D0, D1, D2, D3, D4, D5, and D6 with a change in the gray level of the image signal.

21. The method of claim 17, wherein step (c) comprises:

(c1) storing information on a currently input frame of the image signal resulting from step (a) as previous frame information for a next input frame;

(c2) determining a degree of gray-level transition between each pixel in the current frame and a corresponding pixel in the previous frame based on current frame information of the image signal resulting from step (a) and the previous frame information resulting from step (c1);

(c3) determining whether the current frame is a still image based on the degree of gray-level transition and a predetermined level;

(c4) storing pixel group number information regarding to each pixel in the previous frame based on the gray level of the pixel after being subjected to the gray-level change; and

(c5) when the current frame is determined as not a still image, changing the gray level of the current frame according to a predetermined method using the current frame information, the degree of gray-level transition, the previous frame information, and the pixel group number information.

22. The method of claim 21, wherein step (c5) comprises outputting a gray level of the previous frame when the current frame is determined as a still image in step (c3).

23. The method of claim 21, wherein step (c2) comprises determining the degree of gray-level transition between a particular pixel in the current frame, i.e., a current frame pixel, and a corresponding pixel in the previous frame, i.e., a previous frame pixel, using an average of gray level of all pixels included in a square block that has a predetermined size and has the current frame pixel at its center, an average of absolute values of the gray levels of all of the pixels included in the square block except for the current frame pixel, an average of absolute values of differences between the gray levels of all of the pixels included in the square block and respective gray levels of all pixels included in a square block that has the predetermined size and has the previous frame pixel at its center, and an absolute value of a difference between the gray level of the current frame pixel and the gray level of the previous frame pixel.

24. The method of claim 21, wherein step (c3) comprises determining the current frame as a still image when a ratio of the number of pixels, which are determined as having less motion than a predetermined amount in the current frame of the image signal in step (c2), to a total number of pixels in the current frame is greater than a predetermined value.

25. The method of claim 21, wherein step (c5) comprises comparing the degree of gray-level transition resulting from step (c2) with a predetermined level and changing the gray level of each pixel in the current frame based on the result of the comparison.

26. The method of claim 21, wherein step (c5) comprises comparing the degree of gray-level transition resulting from step (c2) with a predetermined level and when the degree of gray-level transition is lower than the predetermined level and when a pixel group number of a pixel in the current frame, i.e., the current frame pixel, is different from a pixel group number of a corresponding pixel in the previous frame, i.e., the previous frame pixel, changing the pixel group number of the current frame pixel to a pixel group number close to the pixel group number of the previous frame pixel among pixel group numbers adjacent to the pixel group number of the current frame pixel.

27. The method of claim 21, wherein when the gray levels of subfields in the image signal are represented with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule, step (c5) comprises changing weights representing the gray level of the current frame pixel such that an emission pattern of the current frame is the same as that of the previous frame with respect to the weights D3, D4, and D5.

28. The method of claim 21, wherein when the gray levels of subfields in the image signal are represented with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule, step (c5) comprises changing weights representing the gray level of the current frame pixel such that a distribution of on states at the weights D3, D4, D5, and D6 is regular in a diagonal direction when the on states of the weights D0 through D9 are arranged in an increasing order of the gray levels.

29. The method of claim 21, wherein when the gray level of the image signal is divided into 25 gray levels according to a predetermined standard and then pixel group numbers from zero are sequentially allocated to the 25 gray levels, step (c5) comprises not changing gray levels corresponding to the pixel group numbers 0 and 5.

30. The method of claim 29, wherein step (c5) comprises obtaining pixel group number information of the previous frame pixel after being subjected to gray-level change using the following formula:

$$Index_{prev}\{p_e'(i,j;t-1)\} = Index\{p(i,j;t-1)\} - Index_{diff}\{p_e'(i,j;t-1)\},$$

where the $Index$ function indicates a pixel group number corresponding to an input gray value, $Index_{diff}$ indicates a difference between the pixel group number of an original previous frame pixel before being subjected to error diffusion and a pixel group number corresponding to a gray value obtained after the original previous frame pixel is coded and subjected to gray-level change, $p_e'(i,j;t-1)$ indicates the gray level of the previous frame pixel after being subjected to gray-level change and error diffusion, and $p(i,j;t-1)$ indicates the gray level of the original previous frame pixel.

31. The method of claim 21, wherein when the degree of gray-level transition resulting from step (c2) is lower than the predetermined level, step (c5) comprises changing the gray level of the current frame using the following formula:

$$\begin{array}{l} if(index_{prev}\{p_e'(i,j;t-1)\} < index\{p_e(i,j;t)\}) \\ p_e'(i,j;t) = [index\{p_e(i,j;t)\} - 1] \times D_3 + D_{3-1} \\ if(index_{prev}\{p_e'(i,j;t-1)\} > index\{p_e(i,j;t)\}) \\ p_e'(i,j;t) = [index\{p_e(i,j;t)\} + 1] \times D_3 \\ if(index_{prev}\{p_e'(i,j;t-1)\} = index\{p_e(i,j;t)\}) \\ p_e'(i,j;t) = p_e(i,j;t) \end{array},$$

where the $Index$ function indicates a pixel group number corresponding to an input gray value, $Index_{diff}$ indicates a difference between the pixel group number of an original previous frame pixel before being subjected to error diffusion and a pixel group number corresponding to a gray value obtained after the original previous frame pixel is coded and subjected to gray-level change, $p_e'(i,j;t-1)$ indicates the gray level of the previous frame pixel after being subjected to gray-level change and

error diffusion, $p(i,j;t\text{-}1)$ indicates the gray level of the original previous frame pixel, and D_3 indicates a fourth weight when the subfield converter represents the gray levels of subfields in the image signal with weights D0 through D9 in an increasing order from a lower to a higher value according to a predetermined rule.

32. A computer-readable recording medium on which a program for executing the method of claim 17 in a computer is recorded.

33. An apparatus for driving a digital display panel, the apparatus comprising:

an image signal input unit, which separates only an analog image signal from an input composite image signal;

an analog-to-digital converter, which converts the analog image signal to a digital image signal;

a gamma correction unit, which corrects the digital image signal to suit for the characteristics of a plasma display panel (PDP);

a false contour elimination unit, which converts subfields by changing a gray level of the corrected digital image signal depending on a degree of gray-level transition between each current frame pixel and a corresponding previous frame pixel in the image signal so that false contour is minimized; and

a display control unit, which displays the subfield-converted image signal received from the false contour elimination unit on the PDP.

34. The apparatus of claim 33, wherein the false contour elimination unit comprises:

a data converter, which processes the image signal such that a gray level of the image signal exists within a predetermined range;

an error diffuser, which diffuses an error between a gray level of a current pixel in a current frame of the image signal received from the data converter and a gray level of the current pixel in the current frame after being subjected to gray-level change, to pixels adjacent to the current pixel in the current frame;

a first gray-level changing unit, which receives the image signal from the error diffuser, calculates a difference in a gray level between each pixel in the current frame of the image signal and a pixel corresponding to the current frame pixel in a

previous frame of the image signal, and changes the gray level of the current frame pixel based on the gray level difference such that higher weighted subfields among subfields, which illuminate according to the gray level of the current frame pixel, are on a continuous on or off state; and

a subfield converter, which converts a subfield according to a gray level output from the first gray-level changing unit.

35. The apparatus of claim 34, wherein the first gray-level changing unit comprises:

a frame memory part, which receives the image signal from the data converter and stores information on a currently input frame as previous frame information for a next input frame;

an pixel transition determiner, which receives current frame information of the image signal from the error diffuser and the previous frame information from the frame memory part and determines a degree of gray-level transition between each pixel in the current frame and a corresponding pixel in the previous frame;

a still image determiner, which receives the degree of gray-level transition from the pixel transition determiner and determines whether the current frame is a still image based on the degree of gray-level transition and a predetermined level;

a pixel group number storage part, which stores pixel group number information regarding to each pixel in the previous frame based on the gray level of the pixel after being subjected to the gray-level change; and

a second gray-level changing unit, which when the still image determiner determines the current frame as not a still image, changes the gray level of the current frame according to a predetermined method using the current frame information output from the error diffuser, the degree of gray-level transition output from the pixel transition determiner, the previous frame information stored in the frame memory part, and the pixel group number information stored in the pixel group number storage part.

36. The apparatus of claim 35, wherein the second gray-level changing unit changes the gray level of the current frame pixel based on a pixel group number which is obtained using the pixel group numbers of the respective previous and

current frame pixels such that it gives a minimum pattern difference with respect to all of pixel group numbers within a range of variation from –2 to 2.